CALIFORNIA
AIR RESOURCES BOARD

Public Workshop to Discuss Implementation

Low Carbon Fuel Standard

NOVEMBER 28, 2018
SACRAMENTO, CA

CARBON CAPTURE AND SEQUESTRATION PROTOCOL

DETAILS ON CCS APPLICATIONS

THROUGH FUEL PATHWAYS AND THROUGH PROJECT-BASED CREDITING

Carbon Capture and Sequestration Eligibility & Crediting

CARB

Examples of how the CCS Protocol can be used:

- Low carbon fuel pathway (e.g., ethanol or biogas)
- Refinery investment (e.g., steam methane reforming)
- Innovative crude (e.g., co-gen at oilfield)
- Direct air capture

General requirements for Crediting

- Credits go to the capture facility
- Storage facility must be a co-applicant
  - Capture and storage facilities do not need to be co-located
- All CCS projects must receive Permanence Certification before LCFS credit generation is possible

See §95490 and the CCS Protocol for complete application requirements

Carbon Intensity Calculation and Credit Generation for CCS

- Calculate GHG reductions in metric ton/year as described in the Accounting Requirements
  - Life cycle-based approach
  - Serve as credits awarded under project-based crediting provisions (Refinery Investment Credit Program, Direct Air Capture, etc.)
- For fuel pathways involving CCS, CI is calculated as follows:
  - Divide the GHG reductions in MT (above) by MJ of fuel produced in a given year to obtain a CI in gCO_2e/MJ
  - Subtract this CI from the fuel pathway CI without CCS to obtain the net CI for the fuel pathway including CCS

Fuel Pathways with Carbon Capture and Sequestration

Application Process:

- Apply for fuel pathway through the AFP in parallel with CCS permanence certification application
- Fuel pathway with CCS may be approved prior to Permanence Certification, but credits cannot be generated under that pathway until Permanence Certification is issued

Crediting Method:

- Fuel Pathway with reduced CI
  - Must maintain minimum level of injection to maintain CI
  - Must maintain compliance with the Permanence Protocol
- Must have an approved fuel pathway without CCS for situations when capture is not operational (and before permanence certification is issued)

Refinery Investment Projects with Carbon Capture and Sequestration

Application Process:

- Register as a project operator in LRT-CBTS and submit application
- May submit application for review in parallel with Permanence Certification application
- Credits will not be issued prior to issuance of Permanence Certification

Crediting Method:

- Credits to be issued after injection and after verification of reported values from both the capture facility and sequestration facility operator(s)

Innovative Crude Projects with Carbon Capture and Sequestration

Application Process:

- Register as a project operator in LRT-CBTS and submit application
- May submit application for review in parallel with Permanence Certification application
- Credits will not be issued prior to issuance of Permanence Certification
- Reduction in CI to be determined based on difference between oil production with and without CCS

Crediting Method:

- Credits to be issued after verification of reported values from both the capture facility and sequestration facility operator(s)

Direct Air Capture Projects

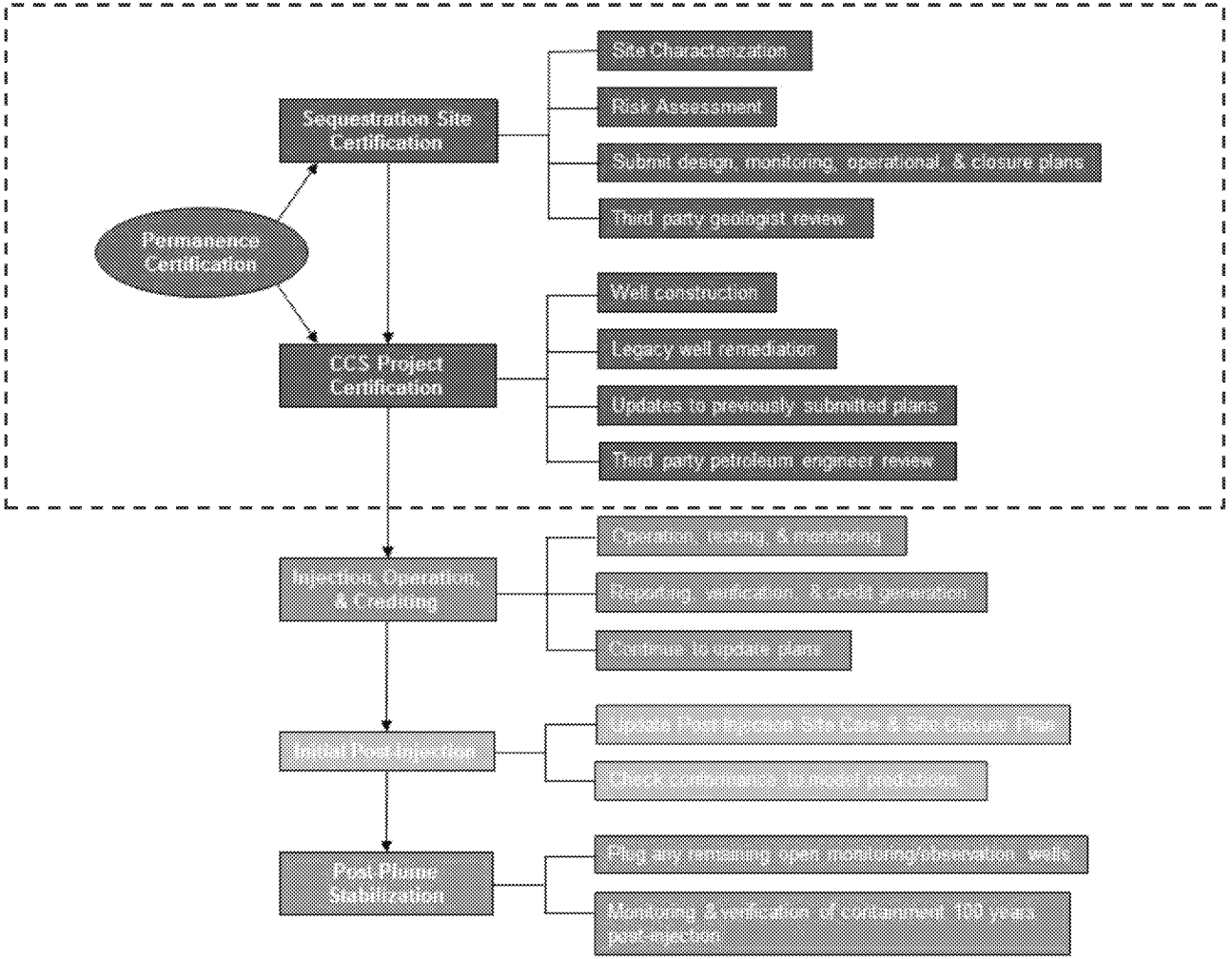
Application Process:

- Register as a project operator in LRT-CBTS and submit Permanence Certification application
- Direct Air Capture projects are not innovative crude projects
  - Direct air capture credits generated regardless of sequestration type

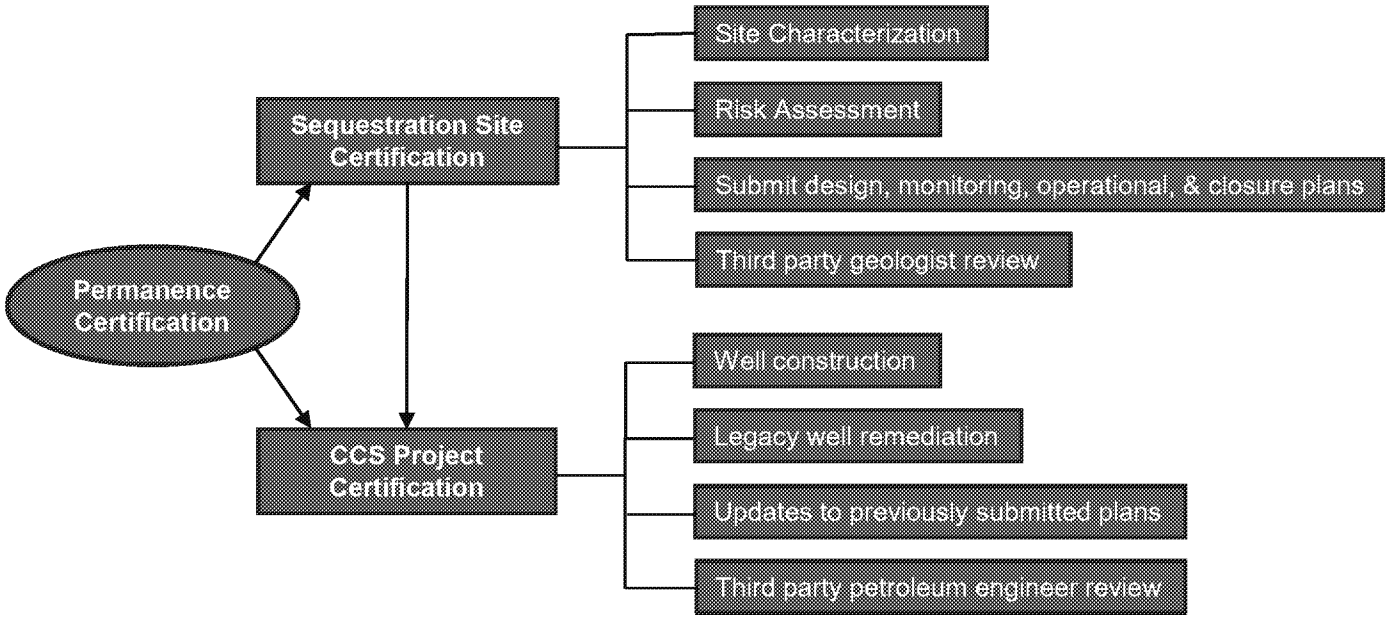
Crediting Method:

- Credits to be issued after injection, and after verification of reported values from the capture facility and sequestration facility operator(s)

CCS Protocol Provisions



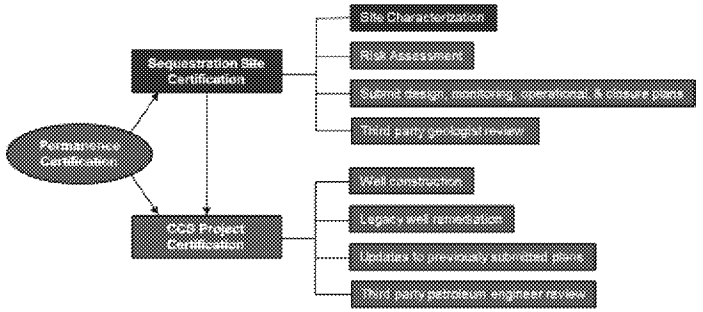
Permanence Certification: Overview



- Apply for permanence certification
- Permanence certification consists of two applications:
  - Sequestration Site Certification Application
  - CCS Project Certification Application

Sequestration Site Certification: Site Characterization

- Geologic Evaluation
  - Formation Testing
  - Well Logging
- Characterize confining layers
- Identify faults and determine whether they are transmissive
- Delineate Storage Complex and provide Computational Modeling Results
  - Must show 90% chance of more than 99% containment over project life (including post-injection site care period)
- Submit Corrective Action Plan
- Submit Baseline Testing and Monitoring Plan
- Identify whether need for dissipation interval



Sequestration Site Certification: Site-Based Risk Assessment

Requirements

- Characterize potential risks of adverse impacts to:
  - Environment
  - Health & Safety
- Minimum Evaluation:
  - Leakage risk
  - Risk scenarios in the Emergency and Remedial Response Plan
- Risk Management Plan:
  - Identify risks and how risks are ranked
  - Steps to manage, monitor, avoid, and minimize risk

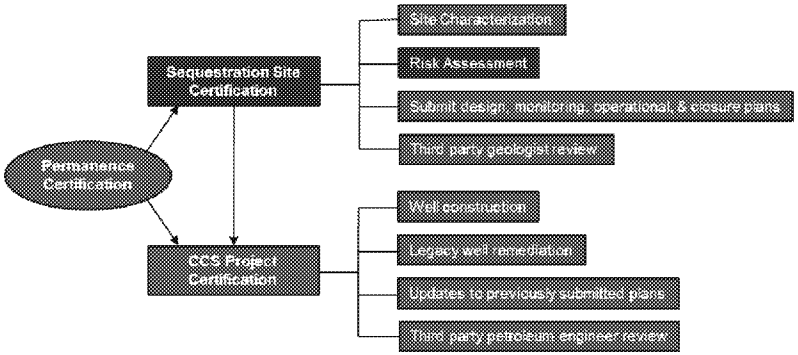


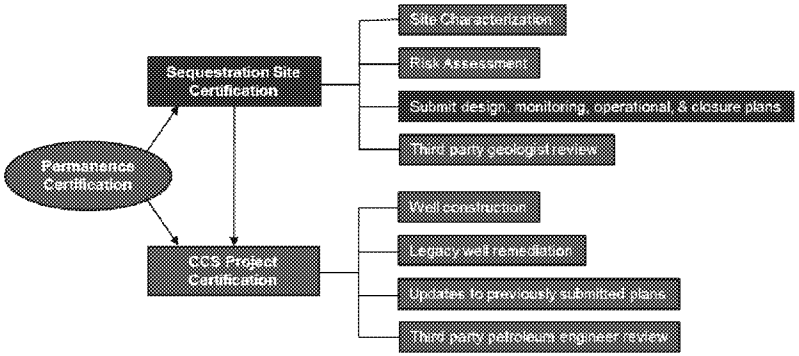
Table 1. Risk scenario classification

	Insubstantial[2]	Substantial[2]	Catastrophic[2]
> 5%[1]	Medium risk	High risk	High risk
1-5%[1]	Low risk	Medium risk	High risk
< 1%[1]	Low risk	Medium risk	Medium risk

[1] Probability of occurrence over 100 years
[2] Severity of potential consequences

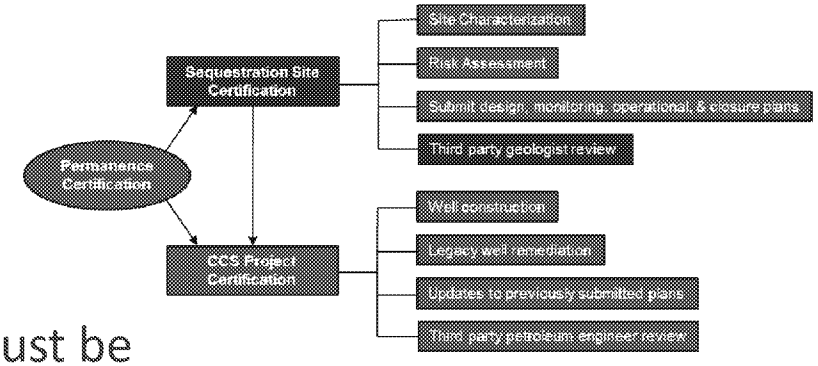
Sequestration Site Certification: Summary of Required Information & Plans

- Site Evaluation
- Risk Assessment
  - Risk Management Plan
- Corrective Action Plan
- Baseline Testing and Monitoring Plan
- Well Construction Plan
- Testing and Monitoring Plan
- Well Plugging and Abandonment Plan
- Post-Injection Site Care and Site Closure Plan
- Emergency and Remedial Response Plan
- Financial Responsibility Demonstration
  - Initial Buffer contribution calculation
- Legal Understanding Demonstration



Sequestration Site Certification: Third Party Geologist Review

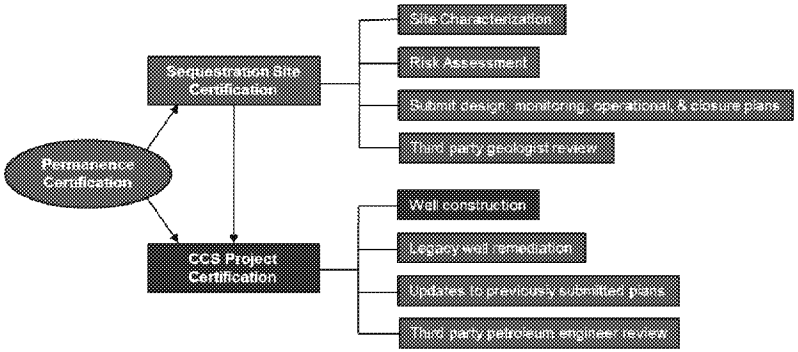
- Application for Sequestration Site Certification must be reviewed and certified by a professional geologist (PG) prior to submittal to CARB
- Professional Geologist credentials and history of work with applicant must be submitted to and approved by CARB prior to review



- PG should include a report in their review commenting on each section of the application and their findings related to whether the section meets the requirements of the CCS Protocol and why
- PG must visit site and confirm that the site description is accurate geographically and geologically
- PG must certify that application materials are accurate and follow best geologic practices

CCS Project Certification: Well Construction

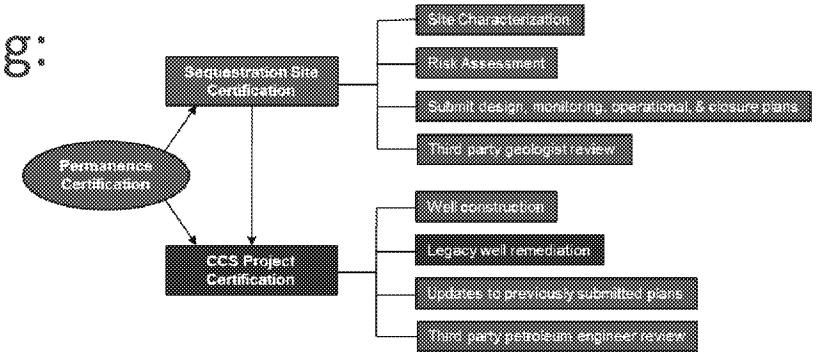
- Formation Testing and Well Logging Report
- Updated Storage Complex Delineation and Computational Modeling Results
- Baseline Testing and Monitoring Report
- Well Construction and Pre-injection Testing Report



CCS Project Certification: Legacy Well Remediation

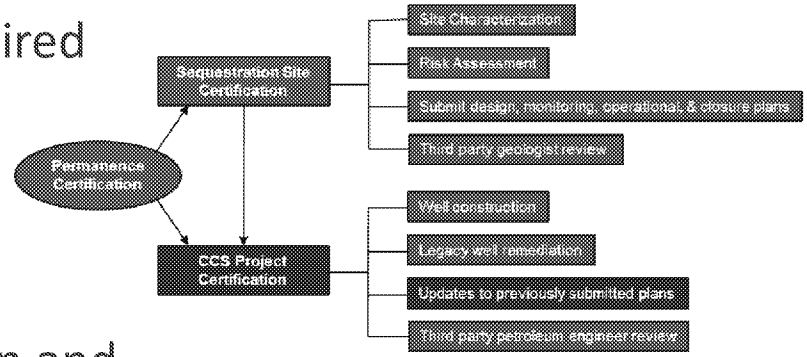
Corrective Action Report describing:

- Methods used to identify wells that required corrective action
- Corrective actions taken on deficient wells that:
  - Penetrate the storage complex
  - Are within the surface projection of the storage complex
- Any historical records search must include a description of the completeness of state or federal databases



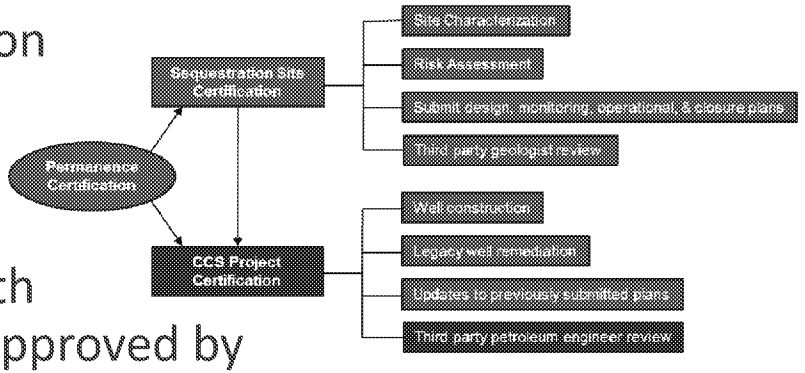
CCS Project Certification: Plan Updates & Required Reports

- Updates to information or plans required by Sequestration Site Certification application
- Formation Testing and Well Logging Report
- Updated Storage Complex Delineation and Computational Modeling results
- Corrective Action Report
- Baseline Testing and Monitoring Report
- Well Construction and Pre-Injection Testing Report



CCS Project Certification: Third Party Petroleum Engineer Review

- Application for CCS Project Certification must be reviewed and certified by a professional petroleum engineer (PE) prior to submittal to CARB
- PE credentials and history of work with applicant must be submitted to and approved by CARB prior to review



- PE should include a report in their review commenting on each section of the application and their findings related to whether the section meets the requirements of the CCS protocol and why
- PE must visit site and confirm that the wells were drilled, cemented and logged accurately and properly, and confirm metering and type of equipment on site
- PE must certify that application materials are accurate and follow best petroleum engineering practices

CCS Application Review Timelines

- Timelines consider ideal situation where applicant is very responsive and little back-and-forth is needed
- Longer response from applicant or incomplete information in submittal may increase timelines
- Timelines for applicants who already have functional projects may be reduced as sequestration site and CCS project certification applications can be combined and reviewed simultaneously
- For applications submitted in Q1, crediting may be possible by end of Q3 2019